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EDITORIAL.

Poetic Diversions of an Engineering Editor.

Many of our readers will be interested to know that Mr. Charles Buxton Going, Editor of the "Engineering Magazine," has brought together, in book form, a goodly number of poems* which he has written from time to time. Many of the poems have already appeared in the pages of representative American periodicals, including various Harper publications, the Century, Scribner's and McClure's magazines. This is hardly the place to characterize the poems, further than to say that most of them are prompted by reflections on such old, but still ever-new, topics as various manifestations of nature, particularly the ocean, the rain and the wind; the yearning of the city dweller for the country; the higher aspirations and affections of men; death and the after-meeting of those separated by it. Several poems of the last-named class show great depth and composure of feeling, and are cast in eminently fitting form.

Three verses from "The Song of Steel," although hardly showing our poet at his best, seem more appropriate than most of the others to columns devoted to the literature of engineering:

Yea, art thou lord, oh Man, since Tubal Cain
Brought me to being, white and torn with pain—
Wrung me, in fierce, hot agony of birth
Writhing from out the womb of Mother Earth?
* * * * * * * * *
Look! We have slain the forests, thou and I—
Soiled the bright streams and murked the very sky;
Crushed the glad hills, and shocked the quiet stars
With roaring factories and clanging cars!

Thou builder of machines, who dost not see!
That which thou mad'st to drive, is driving thee—
Ravening, tireless, pitiless its strain
For thy last ounce of work from hand and brain.

The poem from which these verses are taken is almost the only one in the book which suggests the long-time association of the author with engineers and engineering affairs—a fact or opinion which we give as a mere matter of interest rather than as bearing on the poet, poetry, engineers or engineering. The last poem in the book, however, does hint at the character of the author's workaday world, while at the same time breathing his habit of looking away from it—a habit which might well be acquired by many more of those who are doing the strenuous work of the world. We quote, in conclusion, the poet's "L'Envoi":

See, dear—all day, along the street
And down the dry, hard-beaten road
We keep the treadmill pace of feet
That drive the task or bear the load.

But here's no chart of routes of trade,
Of ton-miles, foot-pounds, rates percent.
These are but byways, where we've made
Field-holiday, and been content

To wander in a wider space
On pathways leading through the bars—
To meet the free wind, face to face—
And overhead, to see the stars!

*Star-Glow and Song.—By Charles Buxton Going. New York: Harper & Bros. Cloth; 5¼ x 8 ins.; pp. 204. $1.20, net.

CORRESPONDENCE.

On a Review of Reid and Reid's "Mechanical Drawing and Elementary Machine Design."

Sir: In your issue of April 15 is published a book review by Prof. George H. Follows, entitled "Mechanical Drawing." The first part of the review is an unmerciful exposure of the weak points of the book, and the second and larger part of the review is a pleasantly platitudinous essay on the teaching of mechanical drawing, accompanied by the subtle suggestion from the editor that

> It is only fair to our readers to state that the author of this review is the author of a "Universal Dictionary of Mechanical Drawing."

Prof. Follows is quite right in his assertion that

> The teaching of mechanical drawing as a craft, only, should cease; drawing should be taught essentially as a language before we can hope for the general adoption of any uniform system of writing it.

If drawing is to be so taught there must be, of course, a standard. The authors of the book under review, in setting up such a standard, place much emphasis upon what they discovered present drafting-room practice to be; and Professor Follows, in no uncertain language, states his opinion of such a standard.

The authors of the book state that

> A circular letter accompanied by a list of thirty-five questions relating to drafting-room practice was submitted to two hundred leading firms in the United States, embracing nearly all kinds of engineering practice.

The replies to these letters are tabulated in the "American Machinist" of the issue of Nov. 19, 1908, and constitute an interesting study of present-day practice. Professor Follows, however, states that this

> is not a reliable guide to what mechanical drawing ought to be; not only because in many drafting rooms the practice is the result either of accident or the work of men whose knowledge of drafting has been picked up.

It is well to note that "two hundred leading firms" were consulted and that about one-half of those who replied to the questions were in accord as to the essentials of drafting practice. It may be needless to add that in some respects present practice, as indicated by these replies, differs from the "Universal Dictionary of Mechanical Drawing," but when it is remembered that

> in many drafting rooms the practice is the result either of accident or the work of men whose knowledge of drafting has been picked up,

this difference may be readily understood.

Granted, as perhaps indeed Prof. Follows himself would say, that we are a nation of engineers with innumerable dialects but with no universal language in drawing, is it not high time something were done? And if practice in drafting rooms is to be made universal, to arrive at that result is it not best to make universal practice conform to present practice so far as present practice may be found good? We are not all gifted enough to write a "dictionary" nor presumptuous enough to call it "universal," but we can commend endeavor in the right direction and cheerfully subscribe to the results gained.

The problem is one that needs solution. Music is a standard "language" the world over, why should not drawing be? The several engineering societies are best equipped to solve the problem and to set up the standard with their far-reaching influence and great following they are in a position to make such a standard and to make it universal. Whether they are in ignorance of the need or whether they question the need itself is not known, but thus far nothing has been done toward establishing such a standard except by the authors of the book in question and by Professor Follows, and they fail to agree.

Yours truly, F. G. Higbee.

Department of Descriptive Geometry and Drawing, University of Iowa, May 3, 1909.

The Author's Comments on the Review of Moyer's The Steam Turbine.

Sir: In the review of my book on The Steam Turbine, which was prepared by Mr. A. G. Christie, Research Assistant in Engineering at the University of Wisconsin, in which capacity he is associated with Prof. Carl C. Thomas, the reviewer, in his criticism, makes a number of incorrect and misleading statements which should be corrected.

The statement that the formula I have given for the length of nozzles "applies only to types where the pressure difference on the two sides of the nozzle is relatively small" can be answered in no way better than by repeating the argument which is presented in the book, that the length of the nozzle influences the efficiency only very slightly and that the formula given can be used with comparatively large ratios of expansion if the nozzle sections are correctly designed for that expansion.* The formula, therefore, needs for practical designing no such qualification as the reviewer proposes. It should be observed, also, that he offers no substitute and of course he knows of none.

Some tests with commercial steam nozzles are now being made under the direction of the author in the laboratories of the University of Michigan. It is believed that as a result of these tests this argument about the proper length of an expanding nozzle is being conclusively settled.

Regarding the exceptions taken by the reviewer to the use of the term "velocity stages" there seems to be no reasonable objection, in the absence again of a substitute, to the use of this term which has come into common use among designers, theorists, and authors in Europe and in America. Such objections made five years ago might have been appropriate and might then have been considered up to date. Now the opposite conclusion must be drawn.

In regard to the use of what the reviewer calls "impulse" blades in a theoretical demonstration for a reaction type of turbine, the author insists, as he has explained on page 62, that it is a mistake to speak of impulse blading and reaction blading, if these terms relate only to the cross sections of the blades. The reviewer evidently considers "symmetrical" and "impulse" as synonymous when used to describe steam-turbine blades. What, then, would he call unsymmetrical blade sections, such as are found in some Curtis turbines?

In regard to the author's methods applying to the design of reaction turbines the reviewer apparently thinks he has something new to present when he writes about "non-adiabatic expansion" in a reaction turbine. It must be assumed, then, that the reviewer got the idea from reading this chapter that reaction turbines were usually designed by assuming an ideal adiabatic expansion. The book actually says that reheating modifies the expansion so much that the true expansion will be entirely different from an adiabatic, all of which, it is explained clearly, is laid out in designing with the use of heat diagrams. And this is the common practice both in Europe and in America. I cannot understand what additional information the reviewer intended to add here unless it was by way of introduction and he was himself preparing a dissertation on Steam Turbines. Has he ever heard of a reaction turbine which was designed with assumed adiabatic expansion?

It seems to the author that it is very unfair for the reviewer to say "that while Curtis and Westinghouse-Parsons turbines are described very fully the author seems to have had no experience with other types." As a matter of fact the author has devoted 13 pages to De Laval turbines, 13 pages to Curtis turbines and considerably fewer pages to what is now known as the Westinghouse-Parsons turbine; and besides, it should be added, that the author has had more practical experience with the operation of De Laval turbines than with Westinghouse-Parsons turbines. It is needless to add

*C. P. Steinmetz, Proc. Am. Soc. of M. E., May, 1908, pp. 627-628.

that the subject matter is obviously so treated. The reviewer will probably himself agree that he has never before seen in any American publication so complete an analysis of the losses and the economy factors of a De Laval turbine as is presented in this book. Why, then, is this matter described as typical of trade catalogs and magazine articles?

The next statement of the reviewer seems to be almost too absurd to mention here. He says that

> the author's statements regarding the relation of altitude and vacuum are misleading. Between the same limits of absolute pressure, the economy of the steam turbine is independent of the altitude and hence relatively high vacuum is as desirable at high altitudes as at sea level.

It only remains for the reviewer to make clear how a "relatively" high vacuum is to be obtained at a high altitude. The information volunteered by the reviewer that the work required of the condenser auxiliaries becomes less as the altitude is increased cannot well be stated as a general proposition. With a barometric condenser the results might be reversed.

The next point is in regard to the best economic results with superheat. The reviewer states in reference to the relative economy of different types of steam turbines that "the author has evidently got his types of turbines interchanged. It is generally understood that Curtis turbines give higher superheats than do the Parsons." Doubtless the help of a Philadelphia lawyer would be of great service to get at the meaning of this statement that Curtis turbines "give higher superheats than do the Parsons." The author will welcome a word from the reviewer in explanation of this criticism. Recognized authorities on turbines have been consulted and they failed to understand the "hidden" meaning. At any time the author will be willing to submit arguments to show that the statements referred to in his book in this connection are correct.

Finally, in regard to the last point in the criticism that in discussing the stresses in rings, drums, and disks the author does not make it clear in one of the mathematical formulas for stress whether a certain symbol means the increase in the thickness of the shaft or the thickness of the shaft itself. All this is absurd. In the whole discussion to which the reviewer refers nothing is stated about shafts as applying to this formula, which is derived for determining the thickness of the drum of the rotor, supported upon a shaft. Evidently the reviewer has been going out of his way to find trouble.

It seems to be very discourteous and professionally unsuitable for a member of Professor Thomas's department at the University of Wisconsin to prepare the sort of criticism which the author has just gone over, considering that Professor Thomas has himself published recently a book* on the same subject which it is desired to introduce into the technical schools and universities for which purpose the reviewer says the book of the author is *unfit*. I shall leave the discussion of this last point to competent authorities without fear that their finding will be unfavorable.

One cannot help observing when reading this review that none of the unique features of the book are discussed even in the slightest detail. All that is new and original is dismissed with the casual remark that the "book is a step in the right direction."

Experimental data relating to a great variety of steam-turbine tests and including particularly a large amount of information concerning nozzle and blade losses which is now so much sought after by designers are to be published in the near future in a separate volume.

James Ambrose Moyer.

Pennsylvania Building, Philadelphia, April 5, 1909.

[Proof of the foregoing letter having been submitted to Mr. Christie, he has replied as follows.—Ed.]:

Sir: I have read advance proof of Mr. Moyer's letter commenting on my review of his book, "The Steam Turbine," and wish to make a few remarks on the letter.

Mr. Moyer's reference to my association with the University of Wisconsin is uncalled for. His book was first read before I became connected with the University, and the review afterwards written without collaboration of any of its staff.

The forthcoming results of the author's tests on commercial steam nozzles will be looked forward to with interest. Until such results are published as to justify an equation which takes no consideration of the pressure ratio in nozzles, such criticism as was made in the review is certainly called for.

With regard to the diagram on page 70, would Mr. Moyer have us believe that "symmetrical" blades are actually used in a reaction turbine?

Regarding the expansion in a turbine, the author states in a foot-note on page 22: "It is very rare in steam turbine work that an expansion departs far from an adiabatic." On page 86 a reheating factor of 40% is introduced and non-adiabatic expansion is shown on the heat-entropy diagram. The inconsistency is evident. The author confirms the review when he says in his letter that designing by the use of the heat diagram is common practice in Europe and America. Why, then, does he produce the old "rule of thumb" methods of Parsons turbine design in his book?

Granting that the DeLaval turbine should have been included with the Curtis and Westinghouse-Parsons, as those on which the author has had experience, and which he describes, his book is still open to the objection given in the review. One of the leading types of American steam turbines is discussed very generally in three pages, and no mention is made of many of its unique details.

Regarding altitude and vacuum, is not a vacuum of 0.7-lb. absolute at 5,000 ft. altitude "relatively" as high as 0.7-lb. absolute at sea-level? Besides, does not a pound of steam give up the same B. T. U. in a given expansion from 165 lbs. absolute to 0.7-lb. absolute in either location? If not, our steam tables need corrections for different altitudes.

Please note that, owing to a typographical error, my review read: "Curtis turbines give higher superheats than do the Parsons," whereas it should have read: "Curtis turbines use higher superheats than do the Parsons." I noted this error on the proof sent to me, but it was not corrected in the printed review.

The author would have us believe that an engineer would build a drum slightly over 3-16-in. thick and 25 ins. in diameter to run at 2,000 r. p. m., and to be grooved to carry rows of blades. This needs no further comment.

The experimental data which Mr. Moyer proposes to publish shortly, in another volume, should have been included in the book under consideration, in which case, his book would have had a decided value. As it stands, it is merely a collection of general information, together with a number of empirical formulas for most of which no justification is offered in the text.

Yours truly, A. G. Christie.

1713 Monroe St., Madison, Wis., April 30, 1909.

*Steam Turbines. By Carl C. Thomas (1906).

REVIEWS.

German and English Books on Gas Engines.

Reviewed by LIONEL S. MARKS,* M. Am. Soc. M. E.

DIE GASMASCHINE.—Ihre Entwickelung, Ihre Heutige Bauart und Ihr Kreisprozess. By R. Schöttler, Professor in the Ducal Technical College at Braunschweig. Fifth edition, revised. Berlin, Germany: Julius Springer. Cloth; 7½ × 10½ ins.; pp. 491; 622 illustrations, mostly in the text. 20 marks; American price, $8.

INTERNAL COMBUSTION ENGINES.—A Reference Book for Designers, Operators, Engineers and Students. By Wm. H. Hogle, Consulting Engineer. New York: McGraw Publishing Co. Cloth; 5½ × 8¾ ins.; pp. 256; 106 illustrations in the text, and 21 tables. $3, net.

THE GAS ENGINE.—By Cecil P. Poole, Editor of "Power and the Engineer," Author of "The Wiring Handbook," etc. New York and London: Hill Publishing Co. Cloth; 6 × 9½ ins.; pp. 97; folding tables and 42 text illustrations. $1, net.

It is now more than twenty years since the first edition of Schöttler's book appeared. It was the standard German work on gas engines until 1902, when there was issued the first edition of Güldner's book. Güldner's treatment of the theory and practice of internal combustion motors was so much more comprehensive and thorough than that of Schöttler that his book took at once the premier place and has occupied it ever since. In his preface Schöttler states that the existence of Güldner's book made it doubtful to him whether it was desirable to bring out a new edition of his work, but he decided finally that his book might be made not to compete with it but, instead, to supplement it. Güldner's book is intended primarily to give the engine designer and builder the necessary basis for his calculations; Schöttler's book has as its avowed aim to introduce the subject to the beginner, particularly in its discussion of the working processes. The book is entirely rewritten, is enlarged very greatly, and must be considered as an entirely new work under a familiar name.

Schöttler's work is characterized by a broad outlook and an intimate knowledge of both practice and theory; it shows, moreover, the results of a close study of experimental data. His chapter on fuels (which follows three chapters on historical development) is comprehensive and authoritative and gives not only a capital resumé of the properties of the various fuels, their occurrence, methods of manufacture and the conditions of their use, but also gives much valuable detailed information on gas cleaning apparatus, particularly for blast-furnace gas and coke-oven gas. Suction-gas plants for various fuels are very fully illustrated and described and include a portable plant, built on the general lines of a portable steam plant. The illustrations, here as elsewhere in the book, are admirably clear and well drawn. The treatment, here as elsewhere, is not merely descriptive but critical; the results of a wide experience are given everywhere to the reader. The theory of gas producers contains some complete analyses of the results of tests of producers.

About one-half of the book (Chapters 8 to 17, inclusive) is given up to a description of the existing types of gas engines and their accessories. This description is well classified and splendidly illustrated with over 400 drawings, of which some are large double-page drawings. These drawings are not dimensioned (as in Güldner's book); they are, however, extremely clear and are chosen and made so as to bring out the varieties of constructive details adopted by different makers. For instruction in the details of gas-engine construction there is no better set of drawings published than those under discussion. The various parts of the engine, the cylinder, bed-plate, frame, cylinder-head, piston and piston rod, valves, valve gears, and so forth, are considered separately, with critical comparative discussion of their special features. Ignition, governing, starting devices, carburetters and vaporizers occupy separate chapters, as do also the modifications of the four-cycle engine, the two-cycle engine, and the constant-pressure ignition engine. This last-mentioned chapter is devoted principally to the Diesel motor, of which many constructions (by various makers), including an opposed cylinder horizontal type, are figured. The most recent news from Germany indicates that double-acting two-cycle Diesel motors are now being constructed, but all that the author has to say on this is that two-cycle Diesel motors are still in the experimental stage.

These descriptive chapters are followed by the discussions of the results of engine tests and of the processes in the engine. The tests are unusually complete and are arranged chronologically under the different fuels, all the important data being given for each test. Many of the engines were tested at various loads and in all such cases economy curves are drawn for the various loads. Gas constants and gas-engine cycles occupy separate chapters. Langen's values of the specific heats of the gases are given the preference over other values, but the greater part of the calculation of the efficiencies of cycles is made on the assumption of constant specific heat. The influence of pressure and of temperature range, of clearance, of the heat value of the charge and of other factors is calculated and tabulated for many types of cycle; the derivation of temperature-entropy diagrams from pressure-volume diagrams either by calculation or by graphical means is explained and illustrated, including the methods for variable specific heat.

The author has made a serious attempt to present the methods and results of investigations for determining the heat exchanges between the working substance and the walls in gas-engine cylinders. The methods of analysis of Rankine, of Weyrauch, of Ayrton and Perry, of Zeuner and of Meyer are expounded. Slaby's elaborate analysis of his tests are reworked with various corrections; and tests by Maercks and Nägel are analyzed. Altogether this is the most comprehensive discussion of this difficult problem that has been published up to the present time, but although the methods are correct the results can in no case be relied upon. There is no way of determining the degree of completeness of the combustion at different parts of the cycle, and the assumption of complete combustion at, or shortly after, the attainment of highest pressure cannot be shown to be correct. Moreover, so long as there is so much doubt as to specific heats, the heat analysis cannot be accepted as accurate. The evaluations of the heat going to the exhaust cannot be determined with any accuracy by Slaby's methods; even the more recent practice of using exhaust calorimeters does not give very consistent results.

*Assistant Professor of Mechanical Engineering, Harvard University, Cambridge, Mass.

The chapter on the calculation of the power of gas engines is similarly comprehensive. The use of a diagram factor does not give results which are as trustworthy as those that can be obtained with the steam engine. The methods discussed are based on experiential or experimental results, and require the knowledge either of the mean effective pressures for different fuels, or of the actual thermodynamic and mechanical efficiencies and the ratio between the piston displacement and the amount of charge taken in. Values are given for these various quantities and the investigations of Nägel are used for determining various coefficients. Beside the above methods the more complicated processes proposed by Barkow and by Meyer are examined at much length; they are methods which will scarcely recommend themselves to the designing engineer (who alone would have occasion to use them) because they offer no more certainty of correct results than the simpler methods suggested earlier. The analyses of gas-engine performances on which they are based are, however, of scientific interest and value.

The discussion of the phenomena of combustion in the gas engine is devoted entirely to the search for the missing quantity of heat and examines the explanations which are usually advanced. In dismissing dissociation the author refers only to the older and comparatively inaccurate work of Mallard and Le Chatelier; the newer and better work of Nernst is not mentioned. The cooling influence of the walls is examined very thoroughly by the aid of the investigations of Slaby, Meyer and Witz, but the recent important work of Clerk is not mentioned.

The final chapters take up the question of uniformity of rotative effort; and the running costs of a number of different types of motors, of various sizes.

The book is written throughout with the student in view. Wherever there is mathematical theory it is illustrated by working out fully certain examples. If it is to be criticised adversely it must be in that it is too comprehensive and too little selective in its methods. The author gives his own views and methods, but gives too much space to a large number of other methods. Moreover, the book is made larger than necessary by including the detailed analysis of many investigations; matter which could have been considerably abbreviated without loss of clearness or completeness. Perhaps the most interesting new contribution is contained in the deductions from Nägel's gas-engine tests; these are distinctly the most accurate and comprehensive tests that have been published and there remains in them yet the possibility of extracting much useful information by proper analysis.

The book making is a good example of Springer's splendid work.

The description of his book by Mr. Hogle as a reference book for designers, operators, engineers and students raises an expectation which is hardly satisfied by the facts. In his preface he speaks of the lack of satisfactory compact reference books on gas engines and recommends, for supplementing his own work, four books, all of which are either very much out of date or are for other reasons of very little value. The only part of his book which can in any sense be regarded as a reference book is that part relating to design, and of that part he says:

> The tables and formulas herein contained should fill all average requirements, either for the designer or the operator, and while neither original *nor compiled especially for gas-engine practice* [they may be found in any standard handbook], the fact that they may be found here assembled should be of advantage.

It is pretty obvious at once that the author does not know what has been published in the field of gas-engine design or else has not seen fit to take advantage of such publication. There are at least two first-class works in gas-engine design in the German language and one in English from which the author could have obtained much information.

The manufacture of small gas engines has been carried out in many cases by mechanics with no knowledge of machine design, and for such persons a book of this character would probably prove useful. The rules of thumb that are given are obviously applicable (though it is not so stated) only to engines of small size, and a general experience with machinery is relied upon rather than calculation in most cases. The rules of thumb are given only for the simpler members of the engine; the reader is consoled for lack of information on certain points by such statements as

> it is not customary for the engine designer to compute any part of the frame, with the exception of the bolts, as it is assumed that it will be amply strong to resist any shock to which it may be subjected

or that the usual method of calculating the weight of the fly-wheel is "tedious and complicated" and "has no very great value to the practical designer."

The book opens with a description of the usual cycles and some practical comparisons. It then takes up practical details of operation, starting devices, carburetters and vaporizers, producers, fuels and combustion, engine compression and the indicator card. These matters are arranged rather inconsequentially and take up half of the book. The chapters on design follow, and last there come descriptions of governing devices, ignition, engine testing, report of tests and various miscellaneous tables. It is not a reference book, nor is it a book for students, as it does not take up even the elementary theory. It is rather a book for a person with practical experience and no technical training. The author is not very happy in his definitions and use of scientific terms. Work is defined as "the sustained exertion of pressure through space." We read that the crank shaft of a gas engine "is subjected not only to the strain due to the conversion and transmission of the power received but, at the beginning of the working stroke, it is subjected to six times the average power of the engine." The author gives a list of average mean effective pressures for various engines and states "the above values are all gage-pressure readings." In the section headed "Alcohol," we find "alcohol being of known chemical composition, unmixed with impurities other than water, has no inherent tendency to foul the interior of the cylinder." These quotations will indicate the unscientific quality of the book. It is not without practical value; its greatest fault is in describing itself as something that it certainly is not.

Mr. Poole's book is not, he states, intended as a complete treatise on the gas engine, but rather "to present the principles governing the salient features of gas-engine construction and operation in as simple a manner as possible." To that end "academic discussions of the characteristics of gases and of hypothetical heat-energy cycles, of the character commonly found in text-books" have been avoided. The avowed intentions of the author will suggest to the judicious the general character of the book. It must be stated, however, that the author has not entirely escaped the thralldom of the academic.

The most prominent feature of his book is a considerable number of tables of figures (some of them on large inserted folded sheets, containing an enormous number of calculated quantities) devoted to the very pleasant academic exercise of giving the piston displacement, to five or six significant figures, of cylinders from 3 to 60 ins. diameter and from ¼ to 9-in. stroke, or to tabulating the pressures and temperatures at various parts of the cycle calculated on various arbitrary assumptions, and to other such academic purposes. The ingenuity of the author in finding things to tabulate is well illustrated by a table of 1,300 quantities giving the expansion ratios corresponding to different stated compression ratios and exhaust valve timings; and by a table of 4,000 quantities giving values of various powers of the ratio of compression. The probability that the designer of a gas engine 60 ins. in diameter should refer to a book of this character for the purpose of determining his piston displacement is rather remote!

Apart from this table mania the book is practical, useful and concise. In many places it is too concise, and in no place is it in any way comprehensive. The illustrations are good and are taken from modern engines.

The subjects dealt with are the methods of operation of four-cycle and two-cycle engines, empirical calculations of pressures and temperatures, water jacketing, valves and valve gears, ignition, carburetters and vaporizers, governing, care and management of engines, and finally some power and efficiency calculations. The descriptive part of the book is the best part; there are a number of things to which exceptions might be found in the other part of the book. A perfect gas, for example, it is stated

> would disappear entirely—become reduced to zero volume—if its temperature and *pressure* were reduced to absolute zero.

These, however, are but minor blemishes; on the whole the book can be recommended to those who, having some knowledge of the steam engine, desire to know how the ordinary gas engine works.

SELECTED BIBLIOGRAPHY OF SANITARY SCIENCE AND ALLIED SUBJECTS.—Arthur W. Smith, Boulder, Colo.: A. A. Greenman. Paper; 5⅝ × 9¼ ins.; pp. 37. 50 cts.

Although limited and somewhat unbalanced in range, this bibliography contains a considerable number of useful references carefully arranged under 14 headings. A consideration of the references included, and also of those omitted, leads one to suppose that the bibliography having been prepared primarily for the use of classes in sanitary science in the College of Liberal Arts, University of Colorado, is based upon books and periodicals available there for reference. Otherwise we cannot understand why some sources should be indexed so fully and others, at least equally well known and valuable, entirely omitted. Under Water-Supply and Sewerage, for instance, practically none of the standard books are mentioned, but chapters of general handbooks of hygiene, etc., are referred to again and again. Garbage and Refuse Disposal receive scarcely any consideration at all. Under Public Health Administration, no mention is made of so valuable a book as Chapin's "Municipal Sanitation"—evidently not because the book was published some years ago, but because it was not at hand. Notwithstanding these peculiarities, the bibliography promises to be serviceable to many aside from those for whom it was specifically designed.

Oil Analysis.

A SHORT HAND-BOOK OF OIL ANALYSIS.—By Augustus H. Gill, Ph. D., Associate Professor of Technical Analysis at the Massachusetts Institute of Technology, Boston, Mass., Author of "Gas and Fuel Analysis for Engineers," etc. Fifth edition, revised and enlarged. Philadelphia and London: J. B. Lippincott Co. Cloth; 5¼ × 8¼ ins.; pp. 179; six illustrations in the text. $2, net.

One of the comparatively few chemical books, which are simple enough to be taken up without immediately previous preparation, in the intervals of an engineer's work is Prof. Gill's "Oil Analysis." It treats a restricted field of engineering chemistry in a practical and utilitarian way. The book has had a steady sale since its first appearance in 1897, which fact testifies, in a measure, to its usefulness. Such changes have appeared in each new edition as advance in engineering practice and in chemical analysis seemed to warrant, until this edition, the fifth, shows material differences from the first.

The author first discusses petroleum products, grouping them into burning and lubricating oils. The methods of making the important tests are concisely given. For the burning oils there are such as the flash, fire, specific-gravity, acidity, sulphur, sulphuric-acid, mineral-salts and water-contents. For the lubricating oils there are, in addition to the flash, fire and specific-gravity tests, the prevalent tests on the viscosity, friction, evaporation, cold behavior, soap and anti-fluorescent content.

The second quarter of the volume is taken up with the standard chemical tests to which the different animal and vegetable oils respond differently, yielding the so-called specific-gravity, Maumene, elaidin, iodine and saponification con-

stants. These tests taken together allow at least an "educated guess" as to what the oil really is and what it may be adulterated with. The author states that only some six oils can be detected with certainty—caster, cokernut, cotton-seed, rosin and sesame—and that we can merely be reasonably sure of three more—corn, rape and sperm.

In addition to the tests noted, there are tests to determine such points as liability to spontaneous combustion and drying-up (oxidizing) quality. Finally there is outlined a definite method of procedure for the examination of an unknown oil to determine its kind, quality and lubricating powers.

The remaining half of the book is given to concise dissertations on the manufacture and examination of the more commonly used oils—animal, vegetable and mineral. This part of the whole book is, perhaps, the most interesting to the ordinary engineer and it should be found a mine of information for his quick and easy reference.

Throughout the whole work great attention has been paid to crediting the researches and writings of the several investigators in this field.

Principles and Practice of American and European Municipal Government.

THE GOVERNMENT OF AMERICAN CITIES.—A Program of Democracy. By Horace E. Deming. A Study of Municipal Organization and of the Relation of the City to the State. Also a Reprint of The Municipal Program of The National Municipal League. New York and London: G. P Putnam's Sons. Cloth; 5 × 8¼ ins.; pp. 323. $1.50, net.

THE GOVERNMENT OF EUROPEAN CITIES.—By William Bennett Munro, PhD., LL.B., Assistant Professor of Government in Harvard University. New York: The Macmillan Co. Cloth; 5¾ × 9 ins.; pp. 409. $2.50, net.

The number of books on municipal government which have been appearing of late is a hopeful sign of the times, particularly in view of their general excellence. Of two of the most notable and most recent of these, one, by Mr. Horace Deming, deals with the principles of municipal government as applied to American cities, and the other, by Prof. William B. Munro, presents in considerable detail the practice of municipal government in France, Prussia and England.

Rarely indeed does one find a subject, generally regarded as vast and complex, treated so simply, clearly and forcibly and with such power of conviction as is the case with Mr. Deming's "The Government of American Cities."

The book should appeal to a broad and various range of readers. It deals with the very fundamentals of municipal government and is presented in a manner which cannot fail to command the respect and admiration of the deepest and most accomplished student of municipal government, while at the same time arousing and holding the interest of those who have before given only a general consideration to the subject or are approaching it for the first time.

Some of the most essential of the principles so ably and forcibly laid down by Mr. Deming in his book may be briefly summarized as follows: Municipal government exists for a definite purpose. Its objects are for the most part entirely distinct from those of state government and should be achieved in accordance with a well-formulated local policy, free from state interference. The policy formulated, machinery must of course be provided to carry it out. This requires a policy-determining and a policy-executing branch of the municipal service, which are commonly known as the legislative and executive divisions of the city government. The members of the executive branch being selected for their fitness through education, training and administrative ability to carry out the policies adopted by the legislative branch, it makes no difference whatever what the politics of the executive officers may or may not be. The members of the legislative branch, being chosen to represent the whole body politic, or all voting citizens, should be so chosen that they will be wholly accountable to the latter and not to any party boss or system. To this end, it is highly important that the elective machinery shall be wholly in the control of the voters themselves, in order that truly representative men shall be put in office. It is also necessary that the elective officers be relatively few in number, so they may be well known to their constituents, both as a means to intelligent choice at election time and to make it always possible to bring the full force of public opinion to bear upon representatives with quickness and ease. Moreover, it is of the highest importance that the elective officers be not only few, but also that, with the exception of the chief executive, or mayor, they be confined wholly to the policy-determining or legislative branch of the government.

For the sake of centralizing administration and fixing responsibility for it beyond question, the mayor should be given full and sole power to appoint and remove all administrative officers. The only exception to this is the comptroller. This officer is the chief fiscal agent of the city and it is his duty to see that city funds are properly administered and expended. He should therefore be appointed by the money-appropriating branch of the city, or the council, rather than by the mayor, who is at the head of the money-spending division.

In so far as municipal legislation and administration relate to purely local matters, the people within any given area are best suited and should have sole power to frame their own government with absolute independence of the state, except in so far as the broad general principles of municipal government are laid down in the state constitution and in legislative enactments, including in the latter the act of the legislature which creates the city corporation itself. Whatever state legislation may be passed for the control of cities should always apply to all the cities of the state.

There are of course some state policies, the carrying out of which the state may wish to supervise; but all state supervision of municipal affairs should be done by a state administrative body, rather than by the legislature.

Having attempted to present the most important of the fundamental principles set forth in the book, some statements may be made regarding its general contents. The author first outlines the city problem in this and European countries, giving particular attention to the English municipal system and its contrast with our own. The domination of cities by American state legislatures is given a chapter and is referred to from time to time throughout the book. The unhappy attempts to carry into municipal government the political doctrines of checks and balances, and short terms of office, so popular in the early history of the United States and its component parts, are portrayed. The awakening of the American people to the importance of municipal government, and particularly to holding the city government responsible to its citizens, is made plain. Other chapters deal with the relation of the city to the state and its citizens, to electoral reforms and to the city charter. The recent adoption of the so-called commission plan of government, of the initiative, the referendum and the recall of elective officers, is reviewed, and lists of cities which have adopted one or more of these plans are given. The two concluding chapters of the main part of the book are entitled "The City the Battle-ground of Democracy" and "Democracy and Efficiency."

"The Municipal Program" of the National Municipal League, formulated ten years ago by a committee of which Mr. Deming was chairman and prime mover, now being out of print, the author has seized this opportunity both of making the "Program" again available and of giving concrete form to the principles which he has laid down. This he has done by reprinting the "Program," prefaced by a general explanation of its features and their reasons.

"The Municipal Program" has already formed the basis of much of the large volume of charter legislation of the past ten years. Many of the charters which are regarded as innovations are really based in considerable part upon "The Municipal Program." We take particular pleasure in referring to these facts because they seem to bear out an assertion which we made in an editorial discussion of "The Municipal Program" in our issue of Nov. 23, 1899, as follows:

> The "Municipal Program," adopted last week by the National Municipal League, is one of the best pieces of constructive work ever done by an organization devoted to the improvement of municipal government.

Mr. Deming's re-presentation of the "Program," with elucidations based upon ten years of experience and observation both on his own part and that of other deep students of the subject, is bound, we think, to give strong added impetus to the remarkable movement for improvement in the machinery of municipal government now in progress throughout the country.

Prof. Munro's "The Government of European Cities" has already been characterized as a book that deals with the practice of municipal government in the countries considered. It lays bare the foundations and outlines the structure of the city government of those countries and exhibits some of the guiding principles of those who have been responsible for it. The author gives for France, Prussia and England a brief but sufficiently full sketch of the history of their municipal government, but reserves most of his space for the presentation of the municipal government of each country as it exists to-day. After the historical portions, the author takes up the relation of the municipality to the state, the general powers and duties of municipalities, their classification (where such exists), the powers and duties of the legislative councils and of the various administrative officers—including, of course, the mayor. It becomes necessary in the case of each country to give special consideration to the government of its capital. Useful comparisons are made of various phases of municipal government of the different European countries, both in relation to each other and to the government of the United States.

Extensive bibliographies are presented for each country and, with the numerous foot-note references, show the breadth and depth of the researches of the author.

There are only three chapters—one for each country—with no subdivisions further than those suggested by the very useful marginal headings.

Obviously, a book of this character is more suitable for reference than for general reading; but this is more on account of the mass of details which the author found it necessary to present, notwithstanding his admirable condensation, than through any fault of style or method of presentation.

The book seems to become progressively interesting as one goes from France to Germany and from Germany to England. This is doubtless due to the closer relation which municipal government in Germany, and still more in Great Britain, has to American municipal government. But the impression left upon the reader is that the increasing interest is also largely due to the fact that as the author moves forward he makes more and more use of valuable and suggestive comparison between the governments of the various countries named.

The reader may naturally inquire how Prof. Munro's work compares with the pioneer studies of municipal government across the Atlantic made by Dr. Albert Shaw some fifteen years ago. While the latter work may not possess to so great an extent as the earlier one what the latter-day magazine editors sometimes call "commanding interest," we cannot but feel that Prof. Munro has done a more solid and discriminating piece of work than did Dr. Shaw. Of course his task has been easier, because Dr. Shaw blazed the way and many others have followed in the intervening years, thus making readily available large masses of well-considered and well-put information. But in addition to this, Prof. Munro has presented the unfavorable as well as the favorable sides of municipal government abroad, far more faithfully than did Dr. Shaw. The latter seems to have seen nearly everything through rose-colored glasses; or, if he saw clearly and discriminatingly the faults that unquestionably exist in municipal government in any and every country, he said little or nothing about them. Perhaps a roseate view was wholly justified at a time when interest in municipal

government in America was only beginning to manifest itself, and when, in order to stimulate and increase that interest, it was necessary to draw the strongest possible contrasts. But however it may have been fifteen years ago, the time has now come for presenting the picture of European municipal government as it is, and not merely at its best; and this, within the limits of the scope and space of his book, Prof. Munro has admirably done. Notwithstanding what we have said regarding Dr. Shaw's "Municipal Government in Great Britain" and "Municipal Government in Continental Europe," we wish to state that in our opinion the country owes a debt of gratitude to him for those volumes, which have been a source of inspiration and helpful concrete suggestion to thousands.

Before leaving these two notable books we wish to call attention to one remarkable impression which they, like other well-considered broad studies of municipal government make upon the reader: namely, that it is the intelligence and spirit of the governed and those who govern, rather than the form of government, which determines the character and the results of municipal administration. And yet careful attention to the form of municipal government pays, just as it pays anywhere and everywhere to adapt form or machinery to the nature of the work to be done.

The Problems of Electric Distribution.

Reviewed by HENRY H. NORRIS.*

THE THEORY OF ELECTRIC CABLES AND NETWORKS.—By Alexander Russell, D. Sc., M. Inst. E. E., Member of the Council of the Physical Society. New York: D. Van Nostrand Co. Cloth; 5½ x 8¾ ins.; pp. 269; 71 illustrations in the text. $3, net.

In considering the electric circuit as a means for conveying power between two points, two sections of the circuit must be recognized. The *transmission line* connects the power plant with the center or centers of distribution; the *distributing system* delivers the power to the receiving apparatus such as motors, lamps, etc. Considerations of economy dictate, in general, the use of overhead, high-tension circuits for transmission. Fire hazard, sightliness, convenience, safety to life and reliability combine to render desirable the concealment of distributing circuits. The design, construction and maintenance of such concealed circuits are radically different from those of overhead circuits. In fact, the problems connected with the two classes of circuits have comparatively little in common. Usually differently-trained electrical engineers specialize in the solution of each. In point of importance the problems of distribution are first, both because distributing systems are more numerous and because they are necessary whether the transmission line exists or not. That is, electric power may be produced by prime movers located on the spot, while the transmission line is built only if it can deliver energy to the distribution system more cheaply than can generators driven by gas or steam engines.

Under the general title "Electric Cables and Networks," Dr. Russell has grouped a number of topics bearing upon distributing circuits. The range of the topics includes the design, construction and maintenance of insulated conductors. The word "theory," which forms part of the complete title, correctly indicates that the basis of the treatment is not "rule-of-thumb" experience, but rather a scientific study of the properties of conducting and dielectric materials both separately and combined into working conductors. At the same time the applications of the theory are not neglected but are kept before the reader by means of problems and of descriptions of commercial methods of rendering the theory useful. The word "theory" as ordinarily used is apt to repel the practical engineer, as it suggests to him something academic and impracticable. This attitude is illogical because the best practice is founded upon sound theory and, without a knowledge of the latter, the practical man can never be entirely self-reliant and independent when new developments impose novel problems upon him. Many books are not available for the average engineer as they are too mathematical and abstruse. This criticism cannot be applied to Dr. Russell's new book. It is a sane combination of a scientific foundation with a practical superstructure. It should therefore be useful to the designer, constructor or operator of distributing systems, and to the technical student whose education should include a sound knowledge of general electrical laws combined with an appreciation of the requirements of commercial electrical practice.

In the preparation of the book the author has drawn upon all available outside sources of information, in addition to his own experience. That he is well qualified to present the theory of the subject is indicated by his authorship of a well-known text on alternating currents, which is much more theoretical than the present treatise.

The sources of information consulted in the preparation of each chapter are indicated by specific references. These include publications by the leading authorities of both continents, and among them are a number of original papers by Dr. Russell. The material gathered from so many sources is carefully analyzed and arranged so that the chapter devoted to each topic, while quite brief, is reasonably complete. The chapters are rather disjointed having, apparently, been written independently and then assembled in logical order. This feature makes it easy to take up any chapter without reference to the others, and this for many purposes is advantageous. As suggested in a previous paragraph, three main divisions of the subject appear to have been in the mind of the author: (1) The principles and practice involved in the design and construction of insulated wires and cables; (2) the design and construction of distributing systems employing insulated wires and cables; and (3) the theory and practice of maintaining such systems in satisfactory working order. The topics may be arranged under these three headings as follows, and a good grasp of the contents of the book may be obtained by this grouping:

(1) Fundamental electrical laws, conductivity, insulativity, dielectric strength, the grading of cables and the heating of cables.

(2) Distributing networks.

(3) Insulation resistance of house wiring and of networks, faults in networks, electric safety valves and lightning conductors.

All of this information is given in readable style and with but little mathematics. The complicated subjects of inductance and capacity of cables are not taken up, as they may be found rather completely treated in the author's "Alternating Currents." There are few books in the field occupied by this one. A large part of the information has only been available to those who have access to large libraries. Even such persons are usually too busy and often insufficiently prepared to read profitably the learned treatises found in the transactions of the technical societies. Dr. Russell's book will make an excellent companion volume to "Electrical Conductors," by the late Dr. F. A. C. Perrine. The latter book treats the subject in a not dissimilar matter but with more reference to overhead conductors and transmission systems.

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THE ENGINEERING INDEX ANNUAL FOR 1908.—Compiled from The Engineering Index published monthly in The Engineering Magazine during 1908. New York and London: The Engineering Magazine. Cloth; 6¼ x 9½ ins.; pp. 437. $2.

This third of the annual volumes of the Index, which in its previous issues dates back to 1884, covers the period from December, 1907, to December, 1908. Although not materially larger than the 1907 volume, it contains 8,248 articles indexed against 7,848 in its immediate predecessor. This compactness is accomplished by a more careful attention to the two or three-line abstracts that describe the contents of each article indexed. The classification by subjects and subclassification alphabetically, which has proved most convenient in the recent issues of the Index are continued in the present volume.

BUILDING CONSTRUCTION AND SUPERINTENDENCE.—By F. E. Kidder, Ph.D., Fellow of the American Institute of Architects, Author of "The Architect's and Builder's Pocket-Book." Revised and enlarged by Thomas Nolan, Fellow of the American Institute of Architects, Assistant Professor of Architecture, University of Pennsylvania. Part I. Ninth edition, revised. Masons' Work. New York: William T. Comstock. Cloth; 6½ x 9¾ ins.; pp. 965; 628 illustrations in the text; numerous diagrams and tables. $6.

From its first publication in 1896 that volume of Mr. Kidder's three-volume work on building construction which takes up mason's work passed through eight editions in the author's lifetime. At the time of his death Mr. Kidder had in mind this last revision, but had not progressed far toward its completion when his final illness overtook him. The work was finished by a friend and collaborator, Prof. Nolan, of the University of Pennsylvania, who not only is well qualified by his own training to carry on the work but who had the assistance of many notes and memoranda prepared by the original author.

The old volume is well known to the building trade and to architects and engineers, both as a student's text-book and a working manual. The new edition embodies all of the old matter, with the exception of obsolete descriptions and discussions, and has added thereto much that is modern. By far the greatest advance is masonry construction since the original edition of the book has been in the line of fireproofing and in concrete and reinforced concrete, so that it is natural that the most pronounced revision and addition should be in the chapters treating these subjects. All the material here is entirely new, and while frankly it purports to add nothing to the present knowledge, the abstracts from current practice and theory have been admirably done. In addition to these additions revisions have been made in the discussions of caisson and cantilever foundations, needing and underpinning and bricks and brickwork. Over 400 new drawings have been added and the tables and appendices amplified.

THE MANUFACTURE OF EXPLOSIVES.—Twenty Years' Progress. Four Cantor Lectures Delivered at the Royal Society of Arts in November and December, 1908. By Oscar Guttmann, M. Inst. C. E. London and New York: Whittaker & Co. Cloth; 6 x 9 ins.; pp. 84; nine plates. $1.10, net.

Mr. Guttmann is the author of an extensive work on the theory and practice of explosives manufacture, in which he covers the subject thoroughly for the benefit of the student and the practitioner. The small volume noted above is mainly a continuation or, perhaps, an appendix to the earlier book, bringing the practice down to the present time. It should be valuable to the explosives expert as a concise resumé of modern development of the art, though it cannot be of great interest to the novice who is anxious to learn something of the underlying principles of that art. A chapter on explosions in coal mines has a very timely interest.

MACHINE DRAWING AND DESIGN FOR BEGINNERS.—An Introductory Work for the Use of Technical Students. By Henry J. Spooner, M. Inst. M. E., Assoc. M. Inst. C. E., Director and Professor of Mechanical and Civil Engineering in the Polytechnic School of Engineering, Regent St., London, Author of "Motors and Motoring," etc. London, New York and Bombay: Longmans, Green & Co. Cloth; 9 x 6¾ ins.; pp. 266; illustrations [about 750] in the text. $1.25.

An idea of the scope of this book can best be given by an enumeration of the subjects treated: 38 pages are devoted to instructions in the use of instruments and the technic of drawing; 76 pages to numerous machine details, such as stuffing boxes, shafting, crank shafts, cranks, etc.; 18 pages to pipes and pipe connections; 26 pages to bearings, hangers, journals and the like; 19 pages to toothed, and 9 pages to belt gearings; 34 pages to engine details; 12 pages to miscellaneous drawing exercises; 10 pages to materials; 24 pages to examination questions.

The cuts are good and in many instances complete in detail. The book abounds with information on many subjects. While it is of great value for reference, it is not suitable for use as an American text-book, on account of the use made of the customary British first-angle projection.—Reviewed by William W. Bird.*

*Professor of Mechanical Engineering and Director of the Washburn Shops, Worcester Polytechnic Institute, Worcester, Mass.

A French Treatise on Marine Boilers.

Reviewed by D. W. TAYLOR.*

CHAUDIERES MARINES ET ACCESSOIRES.—Avec Notes de Résistance des Matériaux et de Thermodynamique. By L. Jauch and A. Masméjean, Professors in the Ecole des Mécaniciens at Toulon. Part I. Toulon, France: J. Aîné. Paper; 6⅛ × 9¾ ins.; pp. 521; 1 folding plate and 300 text illustrations; 37 plates in separate volume, 7¾ × 10¾ ins. 22 francs; American price, $6.60.

The authors of this large, profusely illustrated book are French naval engineers and professors at the Toulon school for seagoing engineer officers. In France, the land of specialization, the seagoing engineers of the Navy are a corps apart from the designing and dockyard engineers. The latter form one corps with the naval constructors and are educated at a special school in Paris after passing through the famous Ecole Polytechnique.

The first two chapters of the book, 84 pages in all, are devoted to applied mechanics and elementary thermodynamics. The authors then devote seven chapters to the general features of boilers and boiler construction, the question of combustion and draft, boiler fittings, transmission of heat and the circulation of water. Next come two long and valuable chapters describing the various types of naval boilers, discussing their merits and demerits and giving the uses to which they are specially adapted. After a few paragraphs on boilers of small boats, feeding boilers, feed pumps, etc., evaporating and distilling apparatus, boiler efficiency, oil burning and steam pipes and valves are taken up in turn. The text concludes with a brief chapter giving the requirements for boiler testing in France, both naval and commercial, and for trials of naval boilers. The table of contents comes last, as usual in French books.

The treatment of the questions considered is, in general, direct and practical. Naturally, the types of boilers and fittings and auxiliaries described are nearly all French, but a certain amount of information concerning English boilers and English machinery is given. One American type of boiler largely used on naval vessels is described and discussed, and reference is made here and there to American experiments.

In discussing merits and demerits of various types of boilers the authors refer to numerous accidents which have occurred to French boilers on trial or in service. Naturally they give few details of these. It would seem that the French marine has been rather unfortunate in this respect during the last ten or fifteen years.

While there is practically no padding in this book, the portions which deal with applied mechanics and thermodynamics are too much condensed to cover their subjects fully, and the first chapter, particularly, has little or no bearing upon the rest of the book. The deduction and discussion of the ellipse of inertia, for instance, has small application to boilers.

On pages 35 to 37 the authors deduce Euler's formula for columns, but they stop short with the theoretical formula, which must be materially changed for use in practice by the introduction of coefficients or constants, as in various well-known formulas based upon the Euler formula.

On page 145, the authors state that should the uptake leading to the smokestack be struck above the protective deck by a projectile, the smoke and gases would come out of the opening and spread through the ship. This idea is generally accepted without question, particularly since the war between Russia and Japan, but recently a doubting Thomas, in command of a U. S. battleship, experimented by making openings into an uptake, and it was found that instead of the smoke coming out, the outside air entered the uptake. This might have been expected from the nature of things, since, even with forced draft, the pressure in the uptakes with a smokestack of moderate height is below the atmospheric pressure. There is no question that for smoke and gases to spread through a ship from a damaged uptake, the latter must be extensively damaged by large jagged holes or a large portion blown away completely. Necessarily, in such a case, the draft would be stopped and the gases escape.

In discussing types of marine boilers, the authors give descriptions of all the types of boilers employed in the French Navy since 1880, when cylindrical boilers were first fitted.

They regard the Belleville as the type of boiler best suited for battleships and armored cruisers and also for ordinary cruisers. The Niclausse boiler they give second place, for such vessels, and regard the Babcock and Wilcox as a rather poor third. These conclusions would hardly be concurred in by engineers of other nationalities but are natural in French writers, particularly as the Belleville boiler has been very extensively used in France. It requires, however, skilful handling and special experience, a fact well exemplified by its history in the English service. When the English Navy, nearly 20 years ago, concluded that it was necessary to adopt water-tube boilers, it plunged upon the Belleville type, which was adopted for all new battleships and cruisers upon the strength of its record in France. It gave poor satisfaction in the English service at first and was so much criticised that a special boiler-inquiry committee was appointed, the final result of which was the abandonment of the Belleville type. But it was not practicable to change the numerous installations of Belleville boilers already in service, and after a few more years experience it was discovered that some engineers were able to get most excellent results out of this type of boiler, and many English engineers concluded that its abandonment had been a mistake.

The chapter upon oil burning is particularly interesting. The French were early in the field with mixed installations fitted to burn coal and oil simultaneously. As long ago as 1895, the French adopted, as a standard practice for large ships, mixed coal and oil burning, requiring that such ships should carry oil amounting to 5% of the weight of coal carried. It appears, however, that the oil-burning installations were never satisfactory, and in 1904 the French Navy gave up fitting them. It was just about this time that the English, after lengthy experiments, made a success of mixed coal and oil burning and adopted it as a standard practice, the United States following for new designs in 1906.

The authors ascribe the failure of the French oil-burning apparatus to the difficulty of regulating the supply of oil injected, to faulty atomization, and to insufficient supply of air for combustion. The French burners were apparently all of the type where steam or compressed air is used to spray the oil. The English burner is a profound Admiralty secret, but it is known that it is of the type which sprays the oil directly, the oil being simply pumped through a steam heater and then through nozzles with openings such that the oil passing out is thoroughly atomized. There is little doubt that the success of the English oil-burning appliances is largely due to their simplicity.

In the chapter on steam pipes, the information concerning French naval practice as regards these important fittings is exceptionally full and complete.

There are a good many typographical errors in the work, many of which are noted in a sheet of errata. There is a blunder on page 445, where the authors ascribe to one English firm the construction of twelve "coastal" destroyers, later called torpedo boats, and four 33-knot destroyers, when, as a matter of fact, these vessels were divided between a number of firms.

The book as a whole is of most value for its erally.

The binding is abominable, the volumes being marine boilers, and next for its sound theories and valuable discussions concerning boilers genfull details of actual French practice as regards lightly stitched together and paper covers pasted on. This, however, appears to be the French custom.

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BOILER FEED WATER.—A Practical Treatise on Its Quality, Effects and Purification. By [illegible]ved. A. Anderson, B. Sc. (Lond.), F. I. C., F. [illegible]S. London, England: "The Electrician" Printing [illegible] Publishing Co., Ltd. New York: The D. Van Nostrand Co. Cloth; 5¼ × 8½ ins.; pp. 160. $2.50.

This book covers the subjects of [illegible]le formation and corrosion, analysis of hard water, calculation of results, water softening, oil and grease and the selection, management, cleaning and inspection of steam boilers. All these topics are considered in a simple way, apparently for the benefit of those not very well versed in the chemistry of the subject. The book contains but little that is new and its only merit appears to be the detailed way in which the subject is considered. So far as analysis of water and interpretation of results are concerned, the book cannot be considered up to date. Perhaps the most interesting topic in the book is that of oil and grease, which is discussed with more detail than is customary in books on boiler waters. Those who are familiar with the American method of expressing results of analyses in parts per million will find it difficult to follow the results expressed in the old English method of grains per Imperial Gallon.—Reviewed by George C Whipple,* Assoc. M. Am. Soc. C. E.

AN INTRODUCTION TO THE SCIENCE OF RADIOACTIVITY.—By Charles W. Raffety. London, New York and Bombay: Longmans, Green & Co. Cloth; 5¼ × 8 ins.; pp. 208; 27 illustrations in the text. $1.25, net.

The author of this little book has "endeavored to give a concise and popular account of the properties of the radio-active elements and the theoretical conceptions which are introduced by the study of radio-active phenomena." It may be said that he has succeeded, and that the book forms an excellent introduction to the subject; yet, one cannot but feel the needlessness of a book of the scope of this one, when we have Makower's "The Radioactive Substances," Bottone's "Radium," and Levy and Willis' "Radium."

The book is divided into three parts: a descriptive part of eight chapters, a theoretical part of eight chapters, and a practical part of five chapters. An appendix contains a summary of the several rays and radio-active elements. The index is very good.

The value of even a popular treatise could be enhanced by the addition of references to the literature. The author does not mention that Boltwood discovered "ionium."—Reviewed by Charles Baskerville.†

ACCURATE TOOL WORK.—By C. L. Goodrich, Department Foreman, Pratt & Whitney Co., and F. A. Stanley, Associate Editor "American Machinist," Author of "The Hill Kink Books" and "American Machinists' Handbook." New York and London: Hill Publishing Co. Cloth: 6 × 9¼ ins.; pp. 217; 221 illustrations in the text. $2, net.

AUTOMATIC SCREW MACHINES AND THEIR TOOLS.—By C. L. Goodrich, Expert on Screw Machine Tools and Department Forman of Pratt & Whitney Co., Author of "Accurate Tool Work," and F. A. Stanley, Associate Editor "American Machinist," Author of "American Machinists' Handbook," etc. New York and London: Hill Publishing Co. Cloth: 6 × 9½ ins.; pp. 255; 284 illustrations, mostly in the text. $2, net.

Jig and tool-making involves a large number of ingenious devices and methods by which is effected the remarkable accuracy and interchangeability of parts found in many forms of modern machinery. Information concerning such devices and methods has been published during the past year in the "American Machinist" and is now presented in book form under the above title, "Accurate Tool Work." The material has been revised and arranged in convenient form for reference, producing a volume which should be of no little interest to any one concerned with this class of work.

The use of master plates, buttons, disks, size blocks, test indicators, accurate gages and the microscope are described and discussed at considerable length. The book appears to be written primarily for the tool-making machinist and the descriptions of methods are given in sufficient detail to enable the reader to make use of the principles involved. Specific operations are described which will suggest the general adaptability of the various devices. A chapter on "Trig-

*Of Hazen & Whipple, Consulting Engineers, 103 Park Ave., New York.

†Professor of Chemistry, College of the City of New York, New York City.

onometry in the Tool Room" contains not a single Greek letter or equation, "not because they have been forcibly suppressed, but because they are not needed." The attractiveness and value of the book are much enhanced by the abundant illustrations.

The second of the two books under review is divided into two sections devoted respectively, to descriptions of various types of automatic screw machines and to specific descriptions of the tools used with them, including information on making and using these tools. The mechanisms and operation of a number of automatic screw, or turret, machines are described in detail and in a way which will interest both machine operators and tool designers. The second section of the book includes suggestions on operating the machines, tables of cutting speeds and feeds and explanations of methods of making and using box tools, forming tools, taps and dies and riveting tools. The final chapter discusses rake and clearance for screw machine tools.

For Those Interested in Mining.

Reviewed by G. MONTAGUE BUTLER.*

A STUDY OF ORE DEPOSITS FOR THE PRACTICAL MINER.—With Description of Ore Minerals, Rock Minerals, and Rocks. A Guide to the Prospector. By J. P. Wallace, M. D., M. Am. Inst. M. E. New York and London: Hill Publishing Co. Cloth; 6¼ x 9¼ ins.; pp. 349; 124 illustrations in the text. $3, net.

It is stated in the foreword that this book has been written for "the average miner, the prospector, and the mining public." In the main, the author has met the requirements of these classes in a satisfactory manner. The many topics discussed are treated in a clear and interesting style and, with some exceptions, as exhaustively as the purpose demands; confusing details and variations are generally omitted, and great care appears to have been taken to refrain from using language too technical for the ordinary unscientific reader.

The author has had, apparently, an unusually long and varied connection with mines and mining, and is therefore qualified to speak from personal observation and experience. The knowledge thus obtained has been notably supplemented by the careful reading of many of the accepted authorities on the more theoretical aspects of the sciences involved. The result is a blending of facts, theories, good practical advice, and apt illustrations which, if the book could be given a wide circulation, would certainly remove the popular misconceptions and superstitions which have been so detrimental to the success of many a prospector and miner, and have retarded the development of the mining industry.

While, as a whole, the work deserves commendation, it is not free from faults and errors which in some instances detract quite seriously from its value. It is marred superficially by evidences of too hasty preparation, such as frequent typographical errors, repetition of almost identical statements, and, in places, by careless grammar. The effort to eliminate technical words is not always productive of good results, for instance, in the substitution of "dough" for magma and "shell-like" for concholdal fracture without further explanation. A few technical terms could not be avoided, and these are too apt to be used loosely or without definition.

Proceeding to a more detailed examination of the book, it is seen that the material is presented under five heads: I. The Ore Minerals; II. The Rock Minerals, Rocks, and Rock Displacements; III. General Characters and Classes of Ore Deposits; IV. Some Types of Ore Deposits; V. Mine Valuation and Prospecting.

With the exception of the discussion of rock displacements, most of the first two parts might well have been omitted without detracting from the value of the book, for the descriptions of the different species of minerals and rocks contain so many errors and omissions, and are often so very elementary as to make their usefulness

*Mining Engineer; Assistant Professor of Geology and Mineralogy, Colorado School of Mines, Golden, Colo.

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doubtful. The author is, of course, handicapped by the assumption that his readers have no knowledge of crystallography beyond that which he imparts on a single page of his book, and that they are even less familiar with other closely allied subjects. However, this fact is no excuse for a number of omissions and misstatements, such as his failure to mention the cleavage of sphalerite, and the statement that "dolerite is a sort of intermediate rock between diorite and gabbro"! He appears to have confined his descriptions of rocks and minerals largely to his own necessarily inadequate observations, instead of availing himself of the work of others and thus rendering his descriptions more comprehensive.

Ore deposits other than those of gold, silver, copper, lead, and zinc are described only in this first part. Merely a brief mention is made of the occurrence of most of them, and some which are of growing importance are entirely omitted. In view of the increasing prominence of the rarer earths and metals, it would seem advisable to give these fuller consideration.

In Part III. the author is on familiar ground, and anyone interested in mining can read with profit the matter there presented. A trained geologist or mining engineer will find some things to criticise adversely and will note the absence of details that appear to him important, but for the practical miner the information given on the origin, character, and peculiarities of ore deposits of all classes is undoubtedly valuable.

Part IV. embodies one of the most interesting features of the book—more or less detailed and fairly accurate descriptions of the geology and character of twenty-three of the greatest mines and mining districts in the world. The author attempts, often most successfully, to apply general principles of the deposition and occurrence of ores to each particular case, thus driving home the points made in a very forceful fashion.

Part V. contains chapters on Mine Valuation, Gold Placers, the Mining of Gold Placers, Prospecting, Value of Prospects, and Gleanings from the Mining Fields. It is difficult to understand why a chapter on the Mining of Gold Placers was included in this book, since little or nothing is presented on the mining of other types of deposits, the subject falling naturally outside of the scope of such a work. Most of the other topics discussed in this part are handled rather superficially but many valuable hints are offered, and the whole can be read with profit.

A Sheaf of German Books.

DES INGENIEURS TASCHENBUCH.—Published by the Society "Hütte." 20th edition. Part III. Berlin, Germany: Wilhelm Ernst & Sohn. Cloth; 4⅛ × 7½ ins.; pp. 830; numerous illustrations in the text. 17 marks; American price, $6.80.

The third volume of the standard German pocketbook, which has now been issued, completes the 20th edition, the first in which the work has been divided into three volumes. The aggregate bulk of the complete work far exceeds what we are used to looking for in a pocketbook. Indeed, the work seems to be developing into a small reference library rather than a portable manual. At the same time, the character of the third volume suggests that the process of extension is not at all near its close. Some of the subjects it deals with are treated in a surprisingly sketchy and superficial way. For example, it would astonish the American engineeer to see how very little is given on surveying (including curves) as compared with the full treatment of curves in our railway engineers' field-books. Some of the other chapters are just as inadequate. On the contrary, much space is wasted with trivial or worthless matter in a few sections, such as that on stresses in structures; for instance, in giving long sets of formulas for the stresses in simple roof trusses under uniform load.

The several chapters are written by specialists in their respective branches. This is no doubt in many respects an advantage, but perhaps it has its disadvantages also. A straw which shows the way the wind blows appears in the first paragraph of the chapter on reinforced concrete. The author lists, as one of the advantages peculiar to reinforced concrete, its "great strength" or "great load capacity"; but the curious expression finds an explanation in the fact that this particular author is a concrete contractor.

We hope that for the sake of preserving the pre-eminent excellence of the "Hütte" as an engineering pocketbook the process of expansion in bulk be carried no farther, and that, in fact, a return be made as soon as practicable to a smaller bulk and a lesser number of volumes.

HANDBUCH DER INGENIEURWISSENSCHAFTEN.—In five parts. Part IV.: Die Baumaschinen. Vol. III.: Lasthebemaschinen, Elektrischer Antrieb von Lasthebemaschinen, Maschinelle Hilfsmittel für die Beförderung von Massengütern, Maschinelle Hilfsmittel und Rüstungen für Hoch- und Brückenbauten, Tauchen und Hebungsarbeiten unter Wasser. By F. Lincke, G. W. Koehler, O. Denecke, Cl. Feldmann, J. Herzog, O. Berndt, L. von Willmann and L. Hotopp. Edited by F. Lincke, Professor in the Technical College at Darmstadt. Second edition, enlarged. Leipzig, Germany: Wilhelm Engelmann. Paper; 7¼ × 11 ins.; pp. 763; 19 plates and 1,079 text illustrations. 32 marks; American price, $12.80.

Contractors' machinery offers a good field for a technical treatise, a field which has remained practically untouched so far as the English language is concerned. The German work, of which the present volume is a second edition, represents a good attempt at covering a part of this field. It is on a very large scale, covering four volumes. Vol. III. deals with hoisting machinery; electric driving of hoisting machines; cars, conveyors, wire-rope tramways, loading bridges and other devices for handling bulk freight; equipment and stagings for building and bridge erection; submarine equipment (diving apparatus, marine wrecking equipment, etc.). This grouping of matter impresses the American reader as rather curious, and the treatment in detail leaves a similar impression. Nor will the work meet the reader's demands in the way of completeness; as a single example, the total omission of anything on cableways is surprising, the more so as wire-rope tramways are well covered. The authors apparently have endeavored to represent besides European also the English and American practice; but, at least so far as the latter is concerned, the attempt is a failure. For this country, therefore, the work is serviceable only as an exposition of practice in Germany.

LEHRBUCH DES TIEFBAUES.—Edited by Karl Esselborn. Third edition, enlarged. Vol. II.: Grundbau, Brückenbau, Wasserversorgung und Entwässerung der Städte, Wasserbau. By Karl Esselborn, Theodor Landsberg, Eduard Sonne and Leo v. Willmann. Leipzig, Germany: Wilhelm Engelmann. Paper; 7½ × 11 ins.; pp. 524; 1,800 illustrations in the text. 15 marks; American price, $6.

We noticed in our issue of Oct. 15, 1908, the first volume of this third edition. The present second volume covers foundations, bridges (steel, timber and stone), water-supply, drainage and sewerage, and hydraulic work in considerable variety (dams, river improvements, canals, etc.) Its value to the American reader is in its giving a fair survey of the state of the art in Germany in the several distinct fields which it includes. It appears to be used largely as a textbook in technical schools, and is not specially adapted to the needs of the practicing engineer.

BEITRAG ZUR BERECHNUNG UND AUSFUEHRUNG DER STAUMAUERN.—By Franz Kr[illegible], Professor in the Technical College at Munich. Munich and Berlin: R. Oldenbourg. Cloth; 5¼ × [illegible] ins.; pp. 54; 20 illustrations in the text. 2.40 marks; American price, $1.

The theoretical development and formulas given in this little monograph are in no way different from the theory of the design of dams as taught in this country. They have the doubtful advantage only that, according to the author's own statement, a "high-grade calculating machine" is necessary for computations by the formulas.

PURE MILK AND THE PUBLIC HEALTH.—A Manual of Milk and Dairy Inspection. By Archibald Robinson Ward, Assistant Professor of Bacteriology and Director of the State Hygienic Laboratory, University of California, Berkeley, Cal. With Two Chapters by Myer Edward Jaffa, Professor of Nutrition and Director of the State Food and Drug Laboratory, University of California. Ithaca, N. Y.: Taylor & Carpenter. Cloth; 6 × 9¼ ins.; pp. 218; 17 illustrations in the text. $2, net.

The author has here presented in relatively small compass the main principles and practices essential to the sanitary and economic supervision of the public milk supply. The book is a model of orderly condensation of a wide range of information, accompanied by numerous references to the more detailed information. It is just what is needed by members of boards of health, secretaries and health officers, to enable them to see what should be done to safeguard the milk supply of a community, and in general how to do it. It will be useful, also, to chemists and bacterfologists, but it makes no pretense of going into the details of the technic of milk examination. For these the reader is referred to other books. The outlines of milk examination, however, are given, including the suggestions for uniform methods of bacterial examination formulated by the committee of the Laboratory Section of the American Public Health Association, reported in 1907 and 1908.

The author takes up in succession the contamination of milk from the time of milking to delivery; changes in milk caused by bacteria; diseases transmitted by milk; bovine tuberculosis and other cattle diseases; municipal and sanitary control of milk; pasteurization; microscopic tests; bacterial examination; certified milk; analysis

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The increasing interest in the matter of clean streets and the absence of any treatise which may serve as a guide to right principles and practices in this branch of sanitation has led to the publication of this book, which consists of notes based upon Dr. Soper's extensive personal experience in work of this kind under peculiarly difficult circumstances, and also upon studies made by him during a visit to Europe in 1907, in an advisory capacity to a commission on street cleaning for New York appointed by Mayor McClellan.

The book is profusely illustrated with views taken by the author of street conditions in different cities, and describing various devices and systems in use for the cleaning of streets and the removal and disposal of refuse. This feature of the book cannot be too highly commended.

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other than bacterial; and adulteration of milk. Appendices give the general milk ordinances of Berkeley, Cal., and Duluth, Minn., and the Chicago tuberculin-test ordinance, which latter went into effect on January 1, 1909. Various blank forms for use in milk inspection are given in an appendix and in the book. These include the dairy score-card adopted in 1908 by the Official Dairy Instructors' Association and published by the Dairy Division of the Bureau of Animal Industry of the United States Department of Agriculture.

The book is a very satisfactory one, and it goes without saying that such a volume should be in every health board library in the land.

Houston's London Water Researches.

METROPOLITAN WATER BOARD (London).—Reports on Research Work, by Dr. A. C. Houston, Director of Water Examinations. (London, England: The Board.) Paper, 8 × 13 ins.

Second Report on the Negative Results of the Examination of Samples of *Raw* Thames, Lee and New River Water for the Presence of the Typhoid Bacillus. Pp. 33.

Third Report on the Storage of *Raw* River Water Antecedent to Filtration. Pp. 47.

Each of these reports is an interesting and valuable contribution to water-research work, but aside from details of bacterial technic and comparisons of bacterial methods the contents of the reports seem to us confirmatory of generally accepted ideas, rather than contributions of new facts. Thus, we should have expected that examinations of samples of the untreated London water-supply would give negative results if searched for the typhoid bacillus, and we have long known that lengthy storage reduces in large measure the bacterial contents of water. We do not mean by these statements to detract at all from the value of these painstaking studies and the remarkably well presented reports upon and deductions from them. The third research report in particular, like the first one (see Eng. News, Sept. 3, 1908, for abstract, and this supplement for Aug. 13, 1908, for a brief notice), is especially valuable in continuing earlier work on the reduction of water bacteria by storage, and in emphasizing the differences that must be considered in providing reservoir capacity for storage purposes only or primarily and in providing storage for bacterial reduction. The third report also contains many data on the physical and chemical improvement of water through storage.

We have spoken of the reports heretofore from their general relation to the research and the literature of the subject. It would be wholly unfair not to take into account their great and distinctive local value; for the logical conclusions to be drawn from the studies is that there is no well-grounded cause for fear of some dire epidemic in London through the continuance of the use of these near-by river sources of water-supply. Dr. Houston makes it very evident that the proper combination of storage and filtration gives a water-supply which, from an analytic point of view, is almost beyond question. Moreover, as was pointed out in the first of these research reports, the vital statistics of London are themselves remarkable evidence of the satisfactory quality of the London supply, even without more storage than is now secured prior to filtration.

Dr. Houston still gives favorable consideration to the possibilities of mechanical filtration in conjunction with storage, but in the present report, instead of suggesting joint storage and mechanical filtration, he seems inclined to favor mechanical filters as the stand-by for the treatment of water in times of flood, or when for any reason adequate length of storage could not be provided. He still balks at making a definite statement as to the maximum period of storage which should be provided before filtration; or perhaps, instead of saying "balks," we should say that he has either not yet come to a final conclusion on that point, or else considers it a matter to be passed upon by or in conjunction with the engineers of the Metropolitan Water Board or by the analysts, the engineers and the Board together.

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Major Sewell is himself a well-known writer on reinforced concrete, and won the Norman Medal in 1905 for his paper in Am. Soc. of C. E., "The Economical Design of Reinforced Concrete Floor Systems for Fire Resisting Structures."

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Lest any of our remarks in the earlier part of this review should be interpreted as indicating that Dr. Houston had not taken cognizance of earlier studies on the relation between storage and bacterial reduction, we wish to say that he gives credit to earlier investigators, and very particularly to Dr. Percy Frankland, who, as many of our readers know, was one of the first to call attention to the value of storage as a means of reducing the bacterial contents of water.

HISTORY OF SANITATION.—By J. J. Cosgrove, Author of "Principles and Practice of Plumbing," etc. Pittsburg, Pa.: Standard Sanitary Mfg. Co. Cloth; 5⅛ × 8½ ins.; pp. 124; numerous illustrations in the text. $1.50.

There are here given in a well-made volume some notes gathered by the author for publication in "Modern Sanitation," which we take to be the house organ of the publishers named in the heading above. The notes relate chiefly to early engineering and architectural works for water-supply, sewerage and public baths. Some attention is given to the development of water-works pumping machinery; also to the early realization of the idea that water-supply is responsible for the transmission of cholera. A few statements are made regarding the introduction of water filters. One would never suppose, from what Mr. Cosgrove writes, that many of the larger cities of this country are already provided with model water filters, and that many other cities have them under construction. A few words are said regarding modern methods of sewage treatment and of garbage disposal by burning, but garbage treatment by reduction, which is practiced in many of the larger cities of the United States, is not mentioned. A brief concluding chapter is entitled "Modern and Recent Plumbing Fixtures." It contains a few interesting statements regarding the history of bath tubs and water-closets. The book contains many interesting and handsome illustrations, chiefly half-tones.

SANITATION AND SANITARY ENGINEERING.—By William Paul Gerhard, M. Am. Soc. M. E., Consulting Engineer for Hydraulic and Sanitary Works. Second revised and enlarged edition of Sanitary Engineering. New York: The Author (33 Union Sq.) Cloth; 4¾ × 7½ ins.; pp. 175. $1.50, net.

The author has here extended some definitions of and notes on the profession and practice of sanitary engineering and on the sanitary engineer in time of epidemics, war, etc., which he published a few years ago. Besides the subjects just mentioned, there are notes on various phases of sanitation between 1850 and 1900, and further notes on the sanitation of Greater New York. A few pages are devoted to some observations on sanitation in Russia, made by an army surgeon in Dresden in 1896.

THE PARK QUESTION.—Part I.: Critical Study and Constructive Suggestions Pertaining to Administrative and Accounting Methods of the Department of Parks, Manhattan and Richmond. New York: Bureau of Municipal Research (261 Broadway). Paper; 6 × 9 ins.; pp. 152; numerous folding diagrams and tables. $1.

A number of New York City departments have been overhauled of late by the Bureau of Municipal Research, with a view of showing how greater efficiency in the administration of municipal departments might be secured, particularly on the line of accounting and statistics. This report first reviews the park situation briefly, then takes up the organization of the Department of Parks in the two boroughs named at the time the report was made, and further on suggests reforms in general administration and in accounting, going into considerable detail as regards the latter. Brief historical and descriptive accounts of each park area in the two boroughs are given. From a summary of the statistics presented, it appears that there are in the Borough of Manhattan 70 separate park areas with a total extent of 1,435 acres and a valuation of $337,789,840.

THE ILLINOIS DEEP WATERWAY.—Report of the Internal Improvement Commission of Illinois. Springfield, Ill.: Pub. Doc. Paper; 6 × 9 ins.; pp. 67; 9 folding maps and profiles.

This commission was appointed in 1907 under an act calling for the investigation of the problems associated with the project of a deep waterway from Lake Michigan to the Gulf of Mexico, and also the reclamation of lands subject to overflow in Illinois. The report reviews the entire project, covering a distance of 1,625 miles, but deals mainly with the proposed section from the end of the Chicago drainage canal to the Illinois River. As far as the lower Mississippi is concerned, it is stated that a navigable depth of 14 ft. can be maintained throughout the average year, and that with the correction of the worst localities it will give a navigable season longer than that of the great lakes. For the Illinois section, the commission proposes a route from Lockport to Utica, with five locks 80 × 900 ft., having a depth of 24 ft. on the sills. The distance is 63.5 miles, following the routes of the Desplaines and Illinois rivers. The cost of this is estimated at $19,957,517, including the locks and four power plants.

OHIO STATE BOARD OF HEALTH.—Annual Report for the Year Ending Dec. 31, 1907. (C. O. Probst, Secy.). Columbus, O.: Pub. Doc. Cloth; 6¼ × 9¾ ins.; pp. 375.

Besides an account of the routine work of the Board in other particultrs, this volume contains reports on applications for approval of water and sewerage systems and purification works, reports on several typhoid outbreaks, water analyses, and abstracts of vital statistics of the state.

REPORT ON THE TEMPERATURES AND VAPOR TENSIONS OF THE UNITED STATES.—Reduced to a Homogeneous System of 24 Hourly Observations for the 33-Year Interval, 1873-1905. Prepared under direction of Willis L. Moore, Chief of Weather Bureau, by Frank H. Bigelow, Professor of Meteorology, in Charge of the Records Division. Bulletin S, Weather Bureau. Washington, D. C.: Pub. Doc. Paper; 9¼ × 11½ ins.; pp. 302; four plates and seven tables.

The general scope of this report is indicated by its title and sub-title. Three sentences from the letter of transmittal may be quoted in the way of additional information as to scope and possible use:

These data, and the normals that have been deduced from them, will form the fundamental basis for future studies on climatology and for the investigation of the relations between plant life and the thermal and hygrometric conditions that prevail in nature. The data have also been so refined in their reductions and corrections as to be of use in the tracing of variations between the sun's activity and the temperatures of the earth. There successful prosecution of their endeavors, need to have these data almost continuously at hand.

Publications Received.

THE ARMOUR ENGINEER.—The Semi-Annual Technical Publication of the Student Body of Armour Institute of Technology. Vol. I., No. 2, May, 1909. (Tracy W. Simpson, Editor.) Publication Office, 33d St. and Armour Ave., Chicago, Ill. Paper; 6¾ × 10 ins.; pp. 133 to 280; illustrated. 50 cts. per copy; $1 per year.

BOARD OF RAILROAD COMMISSIONERS (Massachusetts).—Annual Report, January, 1909. (Walter Perley Hall, Chairman, 20 Beacon St., Boston, Mass.) Boston, Mass.: Pub. Doc. (No. 14). Cloth; 5½ × 9 ins.; pp. xxxvi. + 391 + 628; two large folding maps.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 6 × 9¼ ins.

No. 367: The Significance of Drafts in Steam-Boiler Practice. By Walter T. Ray and Henry Kreisinger. Pp. 60; 26 text figures.

No. 376: Peat Deposits of Maine. By Edson S. Bastin and Charles A. Davis. Prepared in Cooperation with the Maine State Survey Commission. Pp. 127; 3 plates (1 in pocket) and 20 text figures.

No. 378: Results of Purchasing Coal under Government Specifications. By John Shober Burrows. With a Paper on Burning the Small Sizes of Anthracite for Heat and Power Purposes, by Dwight T. Randall. Pp. 44.

COMPLETE YEAR BOOK OF WISCONSIN, ILLINOIS AND IOWA LEAD AND ZINC MINES.—Alphabetically Arranged with Topographical Map of the Lead and Zinc District. Written, Compiled and Edited by the Iowa Farmer Publishers. (Dubuque, Iowa: The Mining Review.) Paper; 9¼ × 6 ins.; pp. 94; illustrated. 50 cts.

CONSERVATION COMMISSION (Wisconsin).—First Report, to The Hon. James O. Davidson, Governor of Wisconsin. (C. R. Van Hise, President Commission.) Madison, Wis.: Pub. Doc. Paper; 6 × 9 ins.; pp. 63; one text illustration.

THE COPPER HANDBOOK.—A Manual of the Copper Industry of the World. Vol. VIII. Compiled by Horace J. Stevens. Houghton, Mich.: The Author. Cloth; 5¾ × 9 ins.; pp. 1,500. $5.

THE DESIGN AND CONSTRUCTION OF INDUCTION COILS.—By A. Frederick Collins. New York: Munn & Co. Cloth; 5¾ × 9¼ ins.; pp. 272; 160 illustrations, mostly in the text, and 123 tables. $3, net.

DESIGNING AND DETAILING OF SIMPLE STRUCTURES.—By Clyde T. Morris, Assoc. M. Am. Soc. C. E., Professor of Structural Engineering, Ohio State University. Ohio State University Civil Engineering Publications, No. 3. Columbus, O.: The University. Cloth; 6 × 9 ins.; pp. 201; 75 illustrations in the text.

DURABILITY AND ECONOMY IN PAPERS FOR PERMANENT RECORDS.—A Report Submitted by H. W. Wiley, Chief of Bureau of Chemistry, and C. Hart Merriam, Chief of Bureau of Biological Survey, Committee on Paper for Departmental Use. Including Paper Specifications, by F. P. Veitch, Chief, Leather and Paper Laboratory, Bureau of Chemistry. Report No. 89, U. S. Department of Agriculture. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9¼ ins.; pp. 51; four text figures.

ELECTRIC RAILWAY POWER STATIONS.—By Calvin F. Swingle. Chicago, Ill.: Frederick J. Drake & Co. Cloth; 5¼ × 8 ins.; pp. 718; 368 illustrations, mostly in the text. $2.

THE FIFTH REPORT OF THE ROYAL COMMISSION ON SEWAGE DISPOSAL.—An Impression. By Gilbert J. Fowler, D.Sc., F.I.C., F.R.SAN.I. (Reprinted from "Public Health," the Journal of the Society of Medical Officers of Health, February, 1909. London, England: 5, Plough Court, Fetter Lane, E.C. Paper; 4¾ × 7¼ ins.; pp. 15.

FOUR CENTURIES OF THE PANAMA CANAL.—By Willis Fletcher Johnson, Author of "A Century of Expansion, etc. New York: Henry Holt & Co. Cloth; 5½ × 8½ ins.; pp. 461; 16 plates and 6 maps. $3, net; by mail, $3.27.

GENERAL MANAGER OF RAILWAYS (Natal).—Report for the Year 1908. (Edward R. Ross, General Manager.) Pietermaritzburg, Natal: Pub. Doc. Paper; 8 × 13 ins.; pp. 63; folding and other plates, and folding tables.

GEOLOGIC ATLAS OF THE UNITED STATES.—U. S. Geological Survey, George Otis Smith, Director. No. 162, Philadelphia Folio, Norristown, Germantown, Chester and Philadelphia Quadrangles: Pennsylvania—New Jersey—Delaware. Washington, D. C.: Pub. Doc. Stiff paper; 18½ × 21¾ ins.; pp. 23; 11 plates and 9 text figures.

HARPER'S MACHINERY BOOK FOR BOYS.—By Joseph H. Adams, Author of "Harper's Electricity Book for Boys," etc. New York and London: Harper & Brothers. Cloth; 5½ × 9 ins.; pp. 373; one plate and numerous text illustrations. $1.75.

HOW TO BUILD UP FURNACE EFFICIENCY.—By Joseph W. Hays, Combustion Engineer, Author of "Combustion and Smokeless Furnaces," etc. Third edition, revised. Chicago, Ill.: The Author (911 Fort Dearborn Building). Paper; 3¾ × 6¼ ins.; pp. 56. 50 cts., postpaid.

HUMAN NATURE IN SELLING GOODS.—By James H. Collins. Philadelphia, Pa.: Henry Altemus Co. Boards; 4¼ × 6¾ ins.; pp. 93. 50 cts., net.

INVESTIGATIONS OF THE COAL FIELDS OF COLORADO, NEW MEXICO, UTAH, OREGON AND VIRGINIA.—By the United States Geological Survey in 1907. With a Bibliography of Survey Papers Relating to Coal, Coke, Lignite and Peat. By H. S. Gale, W. T. Lee, J. H. Gardner, G. B. Richardson, J. S. Diller, W. C. Mendenhall, C. A. Fisher and J. M. Nickles. Advance Chapter from Bulletin No. 341, Contributions to Economic Geology, 1907, Part II. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.; pp. 283 to 436; ten plates and three text figures.

INVESTIGATIONS OF THE COAL FIELDS OF WYOMING.—By the United States Geological Survey in 1907. By J. A. Taff, E. W. Shaw, C. W. Washburne, E. G. Woodruff, E. E. Smith, M. W. Ball, and A. R. Schultz. Advance Chapter from Bulletin No. 341, Contributions to Economic Geology, 1907, Part II. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.; pp. 123 to 282; eight plates and two text figures.

IRRIGATION IN SOUTH DAKOTA.—By Samuel H. Lea, State Engineer, under the direction of Samuel Fortier, Chief of Irrigation Investigations. Bulletin 210, Office of Experiment Stations; A. C. True, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9¼ ins.; pp. 60; one folding map.

MITTEILUNGEN AUS DEM KOENIGLICHEN MATERIALPRUEFUNGSAMT ZU GROSS-LICHTERFELDE WEST.—Herausgegeben im Auftrage der Königlichen Aufsichts-Kommission. 27th Edition, 1909. Berlin, Germany: Julius Springer. Paper; 7⅛ × 10½ ins.; pp. 56; text illustrations and five plates.

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MORTALITY STATISTICS, 1907.—Eighth Annual Report, Bureau of the Census; S. N. D. North, Director. Washington, D. C.: Pub. Doc. Cloth; 9 × 11¾ ins.; pp. 538; diagrams.

OFFICIAL STATISTICS, COMMONWEALTH OF AUSTRALIA.—Commonwealth Bureau of Census and Statistics, Melbourne. Published under the authority of the Minister of Home Affairs by G. H. Knibbs, F.R.S.S., etc., Commonwealth Statistician. Melbourne, Australia: Pub. Doc. Paper; 8 × 13 ins.

Summary of Commonwealth Production Statistics for the Years 1901 to 1907. Bulletin No. 2, Production. Pp. 73.

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OPINIONS AND DECISIONS OF THE RAILROAD COMMISSION OF THE STATE OF WISCONSIN.—Vol. II.: Sept. 14, 1907—Oct. 12, 1908. Compiled by J. M. Winterbotham, Secretary. Madison, Wis.: Pub. Doc. Cloth; 5½ × 9 ins.; pp. 898.

PAVING BRICK AND PAVING BRICK CLAYS OF ILLINOIS.—By C. W. Rolfe, R. C. Purdy, A. N. Talbot and L. O. Baker. Bulletin No. 9, Illinois State Geological Survey. Urbana, Ill.: University of Illinois. Cloth; 5⅞ × 8¾ ins.; pp. 316; 3 plates and 33 text illustrations.

PHILIPPINE COMMISSION.—Report to the Secretary of War, 1908. (James F. Smith, President of Commission.) Annual Reports, War Department, Fiscal Year Ended June 30, 1908. In two parts. Washington, D. C.: Pub. Doc. Cloth; 5½ × 9¼ ins.; pp. 658 and 936; plates and text illustrations in Part II.

PRACTICAL SUGGESTIONS FOR THE DEVELOPMENT OF AMERICAN EXPORT TRADE.—With Directories of the Chief Cities of Brazil, Chile, Panama and Southeast Africa. Chicago, Ill.: The National Business League of America (507 Stock Exchange Building). Paper; 5½ × 8¼ ins.; pp. 91.

PRINCIPLES OF MINING.—Valuation, Organization and Administration. Copper, Gold, Lead, Silver, Tin and Zinc. By Herbert C. Hoover, M. Am. Inst. M. E. New York and London: Hill Publishing Co. Cloth; 6 × 9½ ins.; pp. 199; 45 illustrations in the text. $2.50, net.

THE PURDUE ENGINEERING REVIEW.—Published Annually by the Engineering Societies of Purdue University. No. 4, 1908. (R. G. Bennett, Editor-in-Chief, Lafayette, Ind.) Paper; 5¾ × 8¾ ins.; pp. 174; illustrated. 50 cts.

RAILROAD PROMOTION AND CAPITALIZATION IN THE UNITED STATES.—By Frederick A. Cleveland, Ph.D., and Fred Wilbur Powell, A. M. New York, London and Bombay: Longmans, Green & Co. Cloth; 5¼ × 8 ins.; pp. 368. $2, net.

RAILROAD STRUCTURES AND ESTIMATES.—By J. W. Orrock, Structural Engineer. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 270; 94 illustrations in the text. $3, net; English price, 12s. 6d., net.

REPORT ON THE EXAMINATION OF SOME IRON ORE DEPOSITS IN THE DISTRICTS OF THUNDER BAY AND RAINY RIVER, PROVINCE OF ONTARIO.—By F. Hille. Mines Branch, Canada Department of Mines; Hon. W. Templeman, Minister. Ottawa, Can.: Pub. Doc. Paper; 6½ × 9¾ ins.; pp. 65; folding and other plates, and text illustrations.

REPORT OF THE INDUSTRIAL COMMITTEE ON WELFARE WORK IN CLEVELAND.—Adopted Dec. 22, 1908, by The Cleveland Chamber of Commerce. (E. E. Adams, Chairman of Committee.) Paper; 6¼ × 9 ins.; pp. 18; illustrated.

ROYAL COMMISSION ON COMMUNICATION BETWEEN SYDNEY AND NORTH SYDNEY (New South Wales).—Report. Together with Copy of Commission, Appendices, Evidence and Plans. (Maurice Edwin Kernot, President of Commission.) Sydney, N. S. W.: Pub. Doc. Paper; 8¼ × 13 ins.; pp. xxxiv. + 185; 24 plans in separate board folio; 8¼ × 13¼ ins.

THE RUSSIAN ARMY AND THE JAPANESE WAR.—Being Historical and Critical Comments on the Military Policy and Power of Russia and on the Campaign in the Far East. By General Kuropatkin. Translated by Captain A. B. Lindsay, 2d King Edward's Own Gurkha Rifles, Translator of "The Battle of Tsu-Shima," etc. Edited by Major E. D. Swinton, Author of "The Defence of Duffer's Drift," and Editor of "The Truth About Port Arthur." in two volumes. New York: E. P. Dutton & Co. Cloth; 5¾ × 9 ins.; pp. xxxi. + 309, and 345; plates and maps. $7.50, net.

SEWAGE PURIFICATION AND DISPOSAL.—By J. J. Cosgrove, Author of "Principles and Practice of Plumbing," etc. Pittsburg, Pa.: Standard Sanitary Mfg. Co. Cloth; 5½ × 8½ ins.; pp. 222; 71 illustrations in the text, and 24 tables. $3.

STATE HIGHWAY DEPARTMENT (Pennsylvania).—Report for the Year 1907. (Joseph W. Hunter, State Highway Commissioner.) Harrisburg, Pa.: Pub. Doc. Cloth; 6 × 9¼ ins.; pp. 25; numerous folding and other plates.

STATIONARY TRANSFORMERS.—Theory, Connections, Operation and Testing of Constant-Potential, Constant-Current, Series and Auto Transformers, Potential Regulators, etc. By William T. Taylor, M. Am. Inst. E. E., M. Inst. E. E. New York: McGraw Publishing Co. Cloth; 4¾ × 7½ ins.; pp. 169; 107 illustrations in the text. $1.50, net.

STATISTICS OF RAILWAYS IN THE UNITED STATES.—20th Annual Report (Interstate Commerce Commission), for the Year Ending June 30, 1907. Prepared by the Division of Statistics and Accounts (Henry C. Adams, in Charge). Washington, D. C.: Pub. Doc. Cloth; 5¾ × 9¼ ins.; pp. 789; one folding map.

A STUDY OF ELECTROTHERMAL AND ELECTROLYTIC INDUSTRIES.—By Edgar A. Ashcroft, M. Inst E. E., Assoc. M. Inst. C. E., etc. Statistics by I. J. Moltkehansen, Dipl. Ing., Berlin. In three parts. Part I.: Introductory. New York: McGraw Publishing Co. Cloth; 6 × 9½ ins.; pp. 130; 37 illustrations, mostly in the text. $2, net.

THE VERMONT ENGINEER.—The Annual Publication of The Association of Vermont Engineers. Vol. I., 1909. (Evan Thomas, Editor.) Burlington, Vt.: University of Vermont. Paper; 6 × 9 ins.; pp. 82; illustrated.

WATER-SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9¼ ins.

No. 223: Underground Waters of Southern Maine. By Frederick G Clapp With Records of Deep Wells, by W. S. Bayley. Pp. 268; 24 plates and 4 text figures.

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